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Quantum dot photodetectors: Structures with collective potential barriers¹ ANDREI SERGEEV, LI-HSIN CHIEN, VLADIMIR MITIN, University at Buffalo, SERGE OKTYABRSKY, University at Albany — Major restrictions of room-temperature semiconductor photodetectors and some other optoelectronic devices are caused by short photoelectron lifetime, which strongly reduces the photoresponse. We report our research on advanced optoelectronic materials, which combine manageable photoelectron lifetime, high mobility, and quantum tuning of localized and conducting states. These structures integrate quantum dot (QD) layers and correlated QD clusters with quantum wells (QWs) and heterointerfaces. The integrated structures provide many possibilities for engineering of electron states as well as specific kinetic and transport properties. The main distinctive characteristic of the QD structures with collective potential barriers is an effective control of photoelectron capture due to separation of highly mobile electrons transferring the photocurrent along heterointerfaces from the localized electron states in the QD blocks (rows, planes, and various clusters). Besides manageable photoelectron kinetics, the advanced QD structures will also provide high coupling to radiation, low generation-recombination noise, and high scalability.

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