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Effect of electron-electron interaction on linear and nonlinear optical phenomena in quantum dot systems in interlevel resonance region
VICTOR BONDARENKO, WSU, MIROSLAW ZALUZYNY¹, IF UMCS , YANG ZHAO, WSU — We theoretically investigate linear and nonlinear optical phenomena in quantum dot (QD) systems caused by interlevel transitions. Effect of electron-electron (e-e) interaction in the systems on the optical phenomena is in the focus of the work. The e-e interaction is taken into account by employing the self-consistent field approach in the quasistatic limit. We show that presence of metal surface, and especially another resonant system, can dramatically enhance the effect of the e-e interaction on the optical phenomena. We discuss the conditions for the intrinsic optical bistability in QD systems caused by the e-e interaction. The obtained results can find applications for design, fabrication, and exploiting nanooptoelectronics devices, in part, all-optical components like QD-based optical switches and optical transistors.

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