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Mapping between Quantum-Dot and Quantum-Well Spin-Lasers

JEONGSU LEE, RAFAL OSZWALDOWSKI, CHRISTIAN GOTHGEN, IGOR ZUTIC, SUNY at Buffalo — It has been demonstrated that performance of semiconductor lasers with a quantum-well (QW) active region can be improved by injecting spin-polarized carriers [1-3]. Their rate-equation models have been developed [4-5], however, description of a quantum-dot (QD) spin-laser, demonstrated recently [6], is more complicated [7]. Here, we present a method which allows to employ the simple QW rate equations to study the QD spin-lasers. With this method, one can easily extract QW-like parameters such as differential gain, gain compression factor and time constants. This effort is worthwhile, because the QW spin-laser rate equations have exact analytical solutions, unlike their QD counterparts [7]. Supported by US ONR, AFOSR, DOE-BES, and NSF-ECCS CARRER. [1] J. Rudolph et al., Appl. Phys. Lett. 82, 4516 (2003). [2] M. Holub et al., Phys. Rev. Lett. 98, 146603 (2007). [3] S. Hovel et al., Appl. Phys. Lett. 92, 041118 (2008). [4] C. Gothgen, R. Oszwaldowski, A. Petrou, I. Zutic, Appl. Phys. Lett. 93, 042513 (2008). [5] I. Vurgaftman et al., Appl. Phys. Lett. 93, 031102 (2008). [6] D. Basu et al., Appl. Phys. Lett. 92, 091119 (2008). [7] R. Oszwaldowski, C. Gothgen, and I. Zutic, Phys. Rev. B 82, 085316 (2010).

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