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Theory of Quantum-Dot Spin-Polarized Lasers CHRISTIAN GOTHGEN, RAFAL OSZWALDOWSKI, JEONGSU LEE, IGOR ZUTIC, SUNY, University at Buffalo — Semiconductor spin-lasers, relying on injection of spin polarized carriers, have demonstrated the potential to go beyond magnetoresistive effects, both in steady state [1-5] and modulated-injection regime [6]. Here, we develop Rate Equations to study differences between spin lasers based on Quantum Wells or Quantum Dots as the active region. In the latter system, the carriers are captured in the active region from the wetting layer. The finite capture rate imposes constraints on the parameters determining the laser action threshold. In spite of this, we find that the maximum reduction of the threshold with respect to an equivalent spin-unpolarized Quantum-Dot laser is still sizable. We also discuss how the spin-laser saturation depends on the parameters appearing in the Rate Equations. Supported by ONR, AFOSR, and NSF-ECCS CAREER. [1] J. Rudolph et al., Appl. Phys. Lett. 82, 4516 (2003). [2] M. Holub et al., Phys. Rev. Lett. 98, 146603 (2007). [3] S. Hoevel et al., Appl. Phys. Lett. 92, 041118 (2008). [4] D. Basu et al., Appl. Phys. Lett. 92, 09119 (2008). [5] C. Gothgen, R. Oszwaldowski, A. Petrou, I. Zutic, Appl. Phys. Lett. 93, 042513 (2008). [6] I. Vurgaftman et al., Appl. Phys. Lett. 93, 031102 (2008). [7] J. Lee, W. Falls, R. Oszwaldowski, and I. Zutic, preprint.

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