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Rate equation modeling of semiconductor spin-polarized lasers and diodes[1] CHRISTIAN GOTHGEN, ATHOS PETROU, IGOR ZUTIC, SUNY Buffalo — Optically or electrically pumped spin-polarized carriers into semiconductor lasers can provide important advantages as compared to the conventional lasers in which the carriers are unpolarized. Motivated by recent experiments in spin-polarized lasers which demonstrate the feasibility of polarization modulation and threshold current reduction [1,2], we model these structures using rate equations. Our approach allows a direct comparison of the analytical and numerical results applied to the steady-state laser response. In the absence of material gain, our findings describe the behavior of spin-polarized diodes. We calculate the dependence of threshold reduction on the degree of pumped spin polarization and suggest how a change in the spin polarization could provide several useful device functionalities.
[1] M. Holub et al., Phys. Rev. Lett. 98, 146603 (2007).
[2] J. Rudolph et al., Appl. Phys. Lett. 82, 4516 (2003).

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