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Simulation of Ultrafast Spin-Dependent Hot-Electron Transport in Metallic Multilayers[1] DENNIS NENNO, MARIUS WEBER, HANS CHRISTIAN SCHNEIDER, Kaiserslautern University of Technology — Spin currents in metallic heterostructures can play an important role in connection with ultrafast demagnetization in ferromagnetic materials, as optically excited hot electrons contribute to the non-equilibrium magnetization over the whole range of a multilayer structure. Here, we present our results on two approaches to this problem. First, we apply the Boltzmann transport equation in the homogeneous metal part of a ferromagnet/metal-bilayer and determine the microscopic distribution function of the spin-polarized hot carriers excited in an adjacent magnetic layer. To solve the Boltzmann equation, we reduce the computational domain to an effectively two-dimensional phase space. Carrier-carrier scattering and interactions with phonons are included at the level of a relaxation-time approximation. We have also derived semi-classical equations of motion for the carriers using a particle-in-cell approach. With this approach, we calculate the dynamics of the electrons travelling through the whole bilayer structure, using as input velocities and electronic lifetimes from ab-initio calculations.
D. M. Nenno, S. Kaltenborn and H. C. Schneider, Phys. Rev. B 94, 115102 (2016)

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