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Rate equations for Coulomb blockade with ferromagnetic leads STEPHAN BRAIG, PIET W. BROUWER, Laboratory of Atomic and Solid State Physics, Cornell University, Ithaca, NY 14853 — We derive a density matrix rateequation approach to sequential tunneling through a metal particle weakly coupled to ferromagnetic leads. Our formalism is valid for an arbitrary number of electrons on the dot, as well as for an arbitrary angle between the polarization directions of the leads. The effects of spin-orbit scattering can be included straightforwardly. One of our major results is that, if the electron-electron interactions inside the dot are described by the "universal interaction Hamiltonian", the standard scalar rate equations fail even for collinear or unpolarized leads once occupation numbers larger than two are taken into account. We calculate the linear conductance for the case that transport occurs through one electronic level only, and we show numerical results for multiple levels with up to triple occupation on the dot. For certain configurations, one may observe negative differential conductance.

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