

Spin-polarized spectroscopy of discrete energy levels in metallic nanoparticles

Dragomir Davidovic

School of Physics, Georgia Institute of Technology, Atlanta, GA 30332 U.S.A.

Abstract

Studies of spin-polarized electron tunneling via discrete energy levels of single Aluminum grains are described. Spectral characteristics are used to parametrize the spin-orbit interaction inside the grains. In high resistance samples, spin-polarized current is carried only via the ground state and the few lowest in energy excited states. The spin-relaxation rate, $1/T_1$, which is the rate of electronic transitions from a higher energy level to a lower energy level with spin-flip, is measured for the first time. $1/T_1$ is in the MHz range, and has the correct scaling with the spin-orbit scattering, an evidence that spin-relaxation in Al grains is governed by the spin-orbit interaction and phonon emission. The spin-relaxation rate is 4-5 orders of magnitude smaller than in bulk Al with similar disorder.