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Spin-filter effect of quantum dot with spin-orbit interaction in magnetic field TOMOHIRO YOKOYAMA, MIKIO ETO, Faculty of Science and Technology, Keio University — We theoretically investigate a spin-polarized current generation in a semiconductor quantum dot (QD) with spin-orbit interaction in a magnetic field. In the absence of magnetic field, a spin-polarized current is generated only when the QD is connected to more than two leads.[1] In the presence of magnetic field, on the other hand, we show that the two-terminal QD works as a spin filter due to the spin-orbit interaction even if the Zeeman effect is negligibly small. First, we focus on the vicinity of current peaks of Coulomb oscillation due to the resonant tunneling, considering the two energy levels around the Fermi level in the leads, and obtain an analytical form of spin-dependent current. The spin-polarization of the current is largely enhanced when the spacing between the two levels is smaller than the level broadening due to the tunnel coupling to the leads. Second, we perform a numerical simulation using a realistic model for the confining potential of the QD. We find more than 40% spin-filtering efficiency around some current peaks.

[1]M. Eto and T. Yokoyama, J. Phys. Soc. Jpn. **79**, 123711 (2010).

Tomohiro Yokoyama
Faculty of Science and Technology, Keio University

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