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Efficient spin filter utilizing antidot potential in semiconductor heterostructures TOMOHIRO YOKOYAMA, MIKIO ETO, Faculty of Science and Technology, Keio University — We propose a highly efficient spin filter using artificial potential created by an antidot gate-electrode, STM tip, etc., in semiconductor heterostructures in the presence of spin-orbit interaction. The strength of such a potential is electrically tunable and it can be attractive as well as repulsive. In our previous paper,[1] we formulated the spin Hall effect due to the scattering by the potential in terms of phase shifts and showed that it is extremely enhanced by the resonant scattering when an attractive potential is properly tuned. In the present study, we examine three- and four-terminal devices including an artificial potential as a spin filter. We numerically evaluate the spin polarization of the output current when an unpolarized current is injected from a terminal. With an axially symmetric potential, we observe the spin polarization of more than 50%.[2] Although the polarization is smaller when the axial symmetry is broken, we find that realistic devices could work well as an efficient spin filter.[3]

[1]M. Eto and T. Yokoyama, J. Phys. Soc. Jpn. **78**, 073710 (2009).
[2]T. Yokoyama and M. Eto, Phys. Rev. B **80**, 125311 (2009).
[3]T. Yokoyama and M. Eto, Physica E, in press.

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