Scaling study of Kondo effect in a quantum dot embedded in an Aharonov-Bohm interferometer

RYOSUKE YOSHII, MIKIO ETO, Faculty of Science and Technology, Keio University — The Kondo effect is theoretically investigated in a quantum dot embedded in an Aharonov-Bohm (AB) ring, using the “poor man’s” scaling method. First, we construct an equivalent model in which a quantum dot is coupled to a single lead. The AB interference effect is involved in the magnetic-flux dependence of the density of states in the lead. The scaling analysis of this model yields analytical expressions for the Kondo temperature $T_K$ and logarithmic corrections to the conductance at temperatures $T \gg T_K$. We find that (i) $T_K$ is significantly modulated by the magnetic flux penetrating the ring when the ring size $L$ is much smaller than the size of Kondo cloud, $L_K = \hbar v_F / T_K$, with $v_F$ being the Fermi velocity. $T_K$ is hardly affected by the flux when $L \gg L_K$. (ii) When $L \ll L_K$, the flux dependence of $T_K$ is the smallest around the center of Coulomb valley and becomes remarkable near the edges of the valley.

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