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Renormalization of a single impurity potential of arbitrary strength in a Tomonaga-Luttinger liquid[1] KENJI KAMIDE, YUJI TSUKADA, SUSUMU KURIHARA, Department of Physics, Waseda University, 3-4-1, Okubo, Shinjuku, Tokyo 169-8555 — We study the renormalization flow of a single impurity potential of arbitrary strength in a Tomonaga-Luttinger liquid (TL). It is known that an impurity potential in TL is effectively renormalized by electron-electron interaction, with different manners in weak and strong potential limits for spin dependent models $K_s \neq 1$. This fact strongly suggests that the fixed points of an impurity potential should shift as varying potential strength. In order to determine the scaling fixed points at arbitrary potential strength, we extend boundary bosonization scheme to the problem of arbitrary potential strength, and calculate the local density of states (LDOS) as a function of temperature and distance from the impurity. The impurity scaling flow is determined from the ratio between LDOS at the boundary and in the bulk. For $K_s = 1$, the phase boundary is given by $K_\rho = 1$ irrespective of the potential. For $K_s \neq 1$, we find that the fixed points shift from $K_\rho \sim 2 - K_s$ to $K_\rho = 1/K_s$ as increasing the potential strength from 0 to ∞. We also discuss how the scaling behavior appears in transport experiments.

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