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Charge pumping and ferroelectricity in the disordered one-dimensional system CHYH-HONG CHERN, SHIGEKI ONODA, Spin Superstructure Project, ERATO, and Department of Applied Physics, University of Tokyo, 7-3-1, Hongo, Tokyo 113-8656, Japan, SHUICHI MURAKAMI, NAOTO NAGAOSA, CREST and Department of Applied Physics, University of Tokyo, 7-3-1, Hongo, Tokyo 113-8656, Japan — We consider the adiabatic charge pumping in the isolated disorder system in one dimension. Different from the Thouless charge pumping, the system has no gap even though all the states are localized, i.e., Anderson Localization. The charge pumping can be done by making a loop adiabatically in the 2- dimensional parameter space $\vec{Q} = (Q_1, Q_2)$ of the Hamiltonian. It is because there are many δ-function- like fluxes distributing over the parameter space with random strength, in sharp contrast to the single δ-function in the pure case. This provides a new and more efficient way of charge pumping. On the other hand, we also consider the situation when system is connected with leads, in which the weakly disordered ferroelectrics will be formulated in the Landauer-Buttiker formalism. In this case, the "vortex" structure emerges in the parameter space, which is the origin of the charge transfer for one lead to the other. The vortex core corresponds to the perfect transmittance which can be explained as a resonance tunneling. The time required for the adiabatic charge transfer is also estimated.

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