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Dependency of quantum pumping on transmission mode and dot size KAI-MING LIU, SHIH-YING HSU, Department of Electrophysics, National Chiao Tung University, Hsinchu, Taiwan — We have used e-beam lithography to fabricate sub-micron metal gates on a two dimensional electron gas with mean free path on the order of several micrometers. Negative biases were applied to the metal gates to confine electrons in a small area ($\sim \mu m^2$) forming a so-called quantum dot. Two quantum point contacts (QPCs) served the entrance and exit of electrons in the dot are located in line. Quantum charge pumping phenomena of the open dot in the absence of an external bias was observed using two independent ac voltages with the same frequency, 1$\sim$80MHz, but a phase difference between them. Similar pumping results were reported by Marcus et al. earlier. However, due to the differences in the geometrical arrangements, the behaviors are somehow different including that our pumping current is one order more magnitude bigger and does not increase linearly with frequency for the entire measuring range. Moreover, we found that the pumping current seems increase with decreasing transmission mode numbers of the two QPCs. When the mode number goes to zero and the open dot transforms to closed dot, the pumping current vanishes. The results and measurements of the dependences of quantum charge pumping on transmission mode and dot size will be presented and discussed.

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