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Adiabatic Perturbing a Bloch Transistor by Microwave Irradiation: Inversion of Coulomb Oscillation WATSON KUO, SAXON LIOU, Y.W. SUEN, Department of Physics, National Chung Hsing University, Taichung 402, Taiwan, W.H. HSIEH, C.S. WU, C.D. CHEN, Institute of Physics, Academia Sinica, Nankang 105, Taiwan — We experimentally studied the switching current and DC current-voltage (IV) characteristics of a Bloch transistor irradiated with microwaves of frequency from several GHz up to 18GHz. The photon energy is well below the level spacing of the two-level quantum states so that the Bloch transistor is perturbed in the adiabatic regime. Phase-charge duality in a Josephson junction is clearly seen in the switching current distribution as a function of gate voltage. The reduction of switching current due to photon excitation is significant when the phase fluctuation is small. In particular, an inversion of Coulomb oscillation of switching current is observed at a higher microwave power level. When the microwave frequency is below 7GHz, the IV characteristics of the Bloch transistor evolve from being superconductor-like to being blockade-like as the microwave power level increases, and the zero-bias resistance R_0 shows a Coulomb oscillation accordingly: when R_0 is maximal, the switching current is also maximal, opposite to that without microwave irradiation. As the microwave power level increases further, Shapiro steps in IV characteristics are observed. The step height can be analyzed using a model for an ac voltage source applied to a single Josephson junction.

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