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Cooper pair transport in 1D Josephson chains in the regime $E_C \ll E_J \approx T$.[1] WEN-SEN LU, WENYUAN ZHANG, MICHAEL GERSHENSON, Department of Physics Astronomy, Rutgers, The State University of New Jersey. — We investigated the current-voltage characteristics (IVC) of one-dimensional arrays of SQUIDs in an unusual regime of very small Josephson energies, $E_J \approx 100 - 500mK$, and even smaller charging energies, $E_C \approx 10mK$. The E_C values were realized by shunting the $Al - Al_2O_3 - Al$ Josephson junctions with a large capacitance to the ground. The zero-bias resistance of the 1D chains is dominated by the quasiparticle transport at $T > 0.2K$; below this temperature, only the Cooper pair transport is observed. We have measured the current I_S corresponding to the switching between the low-voltage "phase-diffusion" branch of the IVC and the high-voltage branch ($eV \approx n \cdot 2\Delta$, where n is the number of SQUIDs in the chain, and Δ is the superconducting gap). At $E_J = 100mK$ and $T = 50mK$, the extraordinary small values of $I_S \approx 10^{-13}A$ are 1000 times smaller than the Ambegaokar-Baratoff critical current I_C. The IVC remains hysteretic in this regime, which indicates that dissipation in the chain is weak. The mechanisms of dissipation will be discussed.

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