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Observation of Bloch oscillations and current plateaus in small Josephson junctions array embedded in a network of dc-SQUIDs

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A distinct Bloch nose and current plateaus were measured in the current-voltage characteristics of small Josephson junctions array at low temperatures (T=80 mK) by embedding the array in a network of direct-current superconducting quantum interference device (dc-SQUID) structures. The dc-SQUID structures in the design were used to serve as RF current sources owing to ac Josephson effect and also to vary the impedance around the small Josephson junctions array via introducing a magnetic field perpendicular to the dc-SQUID structures. The observed current plateaus seem to be a phase locking phenomenon between coherent oscillations of Cooper pairs in small Josephson junction, Bloch oscillations, and the RF signal from the dc-SQUIDs. The magnitude of the current plateaus was measured to as high as 300 pico-Ampere. The demonstrated result has a potential in renovating the calibration technique of dc-current in electrical metrology by modifying the dc-current definition as the product of Cooper pair charge and frequency.

Biography

S. Gandrothula has completed his Ph.D. from The University of Electro-Communications, Tokyo, Japan in 2013. He has been working as a post-doctoral fellow at National Metrology Institute of Japan (NMIJ) and also a fellow in the Innovation school of AIST, Japan.

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