

Manifestation of Devil's staircase and Negative Differential Resistance in the IV- Characteristics of φ_0 Josephson Junction

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The anomalous Josephson structures with coupled superconducting and magnetic characteristics allows the manipulation of magnetic properties by Josephson current [1]. In junctions with a strong spin-orbit coupling (φ_0 Josephson junction), we demonstrate an appearance of additional fractional subharmonic steps in the IV-characteristics under external electromagnetic radiation due to spin-orbit coupling. An origin of subharmonic steps is related to the locking of magnetic moment precession to the Josephson oscillations. We prove that the positions of those steps follow a continued fraction algorithm. In addition to this, we demonstrate the appearance of negative differential resistance on the IV-characteristic, resulting in an additional locking step of magnetic precession [2]. We show that it is possible to control not only the frequency but also the amplitude of the magnetic precession in the locking region.

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