Peculiarities of Buzdin and Chimera Steps in the IV-Curve of Superconductor Ferromagnetic φ_0 Josephson Junction

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In the presence of external electromagnetic radiation, the magnetization and current-voltage characteristics of superconductor-ferromagnet-superconductor φ_0 Josephson junctions have been studied. Due to the coupling of superconductivity and magnetism in this system, the magnetic moment precession of the ferromagnetic layer caused by the magnetic component of external radiation can lock the Josephson oscillations, which results in the appearance of a particular type of steps in the current voltage characteristics, completely different from the well-known Shapiro steps. These steps are called the Buzdin steps in the case when the system is driven only by the magnetic component and the Chimera steps in the case when both magnetic and electric components are present [1]. Unlike the Shapiro steps where the magnetization remains constant along the step [2], here it changes though the system is locked. We also, demonstrate the implementation of dieffrent types of dynamical states of magnetization[3]. These states in the synchronization region are distinguished by the type of magnetic moment precession and their Josephson oscillations have phase difference of π [3]. The possibility of switching between these states using a current pulse is demonstrated. Transitions between these states with increasing and decreasing bias current show hysteresis, which is reflected in the bifurcation diagram and the current-voltage characteristics. Additionally, we demonstrate how the results can be verified experimentally

by measuring the phase shift in voltage temporal dependence at fixed current values in both directions. Various applications of the results obtained can be found in the field of superconducting spintronics and quantum computing.

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References

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