Energy Dissipation Effects in the Dynamics of a Josephson Junction Between Two Binary Bose-Condensed Mixtures

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The dissipative dynamics of a pointlike Josephson junction in binary Bose-condensed mixtures is analyzed within the framework of the model of a tunneling Hamiltonian. The transmission of unlike particles across a junction is described by the different tunneling amplitudes I_1 and I_2. The effective action that describes the dynamics of the phase differences φ_1 and φ_2 across the junction for each of two condensed components is derived employing the functional integration method. In the quasiclassical low-frequency limit the dynamics of a Josephson junction can be described by two coupled dynamical equations in terms of the potential energy $U(\varphi_1, \varphi_2)$ and dissipative Rayleigh function $R(\dot{\varphi}_1, \dot{\varphi}_2)$ using a mechanical analogy. The Ohmic-like energy dissipation appears in the second-order terms in the tunneling amplitudes and intensifies infinitely with approaching at the demixing point. The interplay between mass currents of each mixture component results from the crossed second-order term in the tunneling amplitudes due to interspecies hybridizing interaction.