Contribution ID: **26**   Type: **ORAL**

Engineering the speedup of quantum tunneling in Josephson systems via dissipation

Tuesday, 4 October 2022 18:00 (30 minutes)

It is common sense that when a quantum coherent system is not perfectly isolated from the environment, quantum effects are destroyed and the system fundamentally follows the classical mechanics'rules. This is not always the case. Indeed, the dissipative interaction, namely the interaction between a quantum system and its external bath, can lead to an enhancement of quantum effects.

In this work [1] we show that a such situation can occur in a superconducting Josephson circuit with an extremely simple scheme to achieve the opportune dissipation that plays the desired game. In our proposal, we show that the engineered electromagnetic environment formed by the external impedances and coupled to a current bias Josephson current can enhance the quantum tunneling of the superconducting phase from a metastable state. This environmental assisted quantum tunneling can therefore speed up the relaxation dynamics of the phase towards the absolute energy minimum. This provides a proof of concept opening the route for the promising perspective of using quantum dissipative Josephson circuits as quantum simulators for optimization problems.

[1] https://arxiv.org/abs/2203.08705,
accepted in Phys. Rev. B
https://journals.aps.org/prb/accepted/5a07cO56D8d1cb4794a426b6bf98688ac3c032d68

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Session Classification: Talks