ガルバニック結合を用いた共振器－導波路間可変結合

Galvanically connected tunable coupler between a cavity and a waveguide

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One of the key technologies in recent quantum devices is the tunable coupling among quantum elements such as qubits, cavities, and waveguides. In this work, we propose a cavity-waveguide tunable coupler with an excellent on-off ratio, which is realized in a semi-infinite waveguide equipped with a tunable stub [1]. The working principle of the present device is the shift of the node position of the cavity mode induced by the tunable boundary condition at the stub end. When the node position is adjusted to the branch point of the waveguide, the cavity mode becomes decoupled from the waveguide modes in principle. At the same time, owing to the galvanic connection, the present device readily achieves an ultrastrong cavity-waveguide coupling, where the cavity decay rate is comparable to the cavity resonance frequency. We also present the numerical simulation results based on COMSOL.

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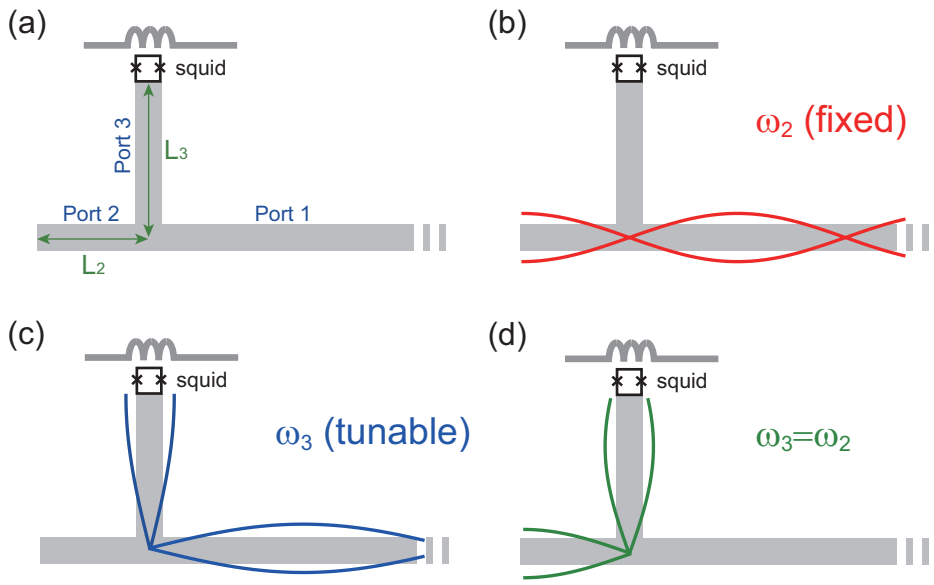

図 1: (a) Schematic of the investigated setup. (b),(c) Eigenmode having a node at the waveguide branch. The eigenfrequency ω_2 is fixed ($= \pi v/2L_2$), whereas ω_3 is tunable through the boundary condition at the SQUID. (d) Cavity mode decoupled from the waveguide, which is formed when $\omega_3 = \omega_2$.

参考文献

[1] K. Koshino, arXiv:2409.13970.

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