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(G*) Engineering non-Gaussian bosonic gate by quantum signal processing

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Non-Gaussian operations are essential for most bosonic quantum technologies. Yet, realizable non-Gaussian operations are rather limited in type and generally suffer from accuracy-duration tradeoffs. In this work, we propose to use quantum signal processing to engineer non-Gaussian operations. For systems dispersively coupled to an auxiliary qubit, our scheme can generate a new type of non-linear phase gate. Such a gate is an extension of the selective number-dependent arbitrary phase (SNAP) gate, but an extremely high accuracy can be achieved within a reduced, fixed, excitation-independent interaction time. Our versatile formalism can also engineer operations for a variety of tasks, e.g. processing rotational symmetric codes, entangling qudits, deterministically generating multi-component cat states, and converting entanglement from continuous- to discrete-variable.

Keyword-1

non-Gaussian gate

Keyword-2

quantum signal processing

Keyword-3

hybrid quantum system

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