

## Gaussian Operations with a Single Trapped Ion

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**Abstract :** In this letter, we review the literature of the major concepts that govern Gaussian quantum information. As we work with quantum information and computation with continuous variables, Gaussian states are needed to better describe these systems. Analyzing a single ion locked in a Paul trap we use the interaction picture to obtain a toolbox of Gaussian operations with the ion-laser interaction Hamiltonian. This is achieved exciting the ion through the combination of two lasers of distinct frequencies corresponding to different sidebands of the external degrees of freedom. First we study the case of a trap with 1 mode and then the case with 2 modes. In this way, we achieve different continuous variables gates just by changing the external degrees of freedom of the trap and combining the Hamiltonians of blue and red sidebands.

**Keywords :** Paul trap, ion-laser interaction, Gaussian operations

**Conference Title :** ICEQIS 2014 : International Conference on Engineering and Quantum Information Sciences

**Conference Location :** Lisbon, Portugal

**Conference Dates :** April 16-17, 2015