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(54) Title: **HARDWARE-EFFICIENT NEUTRAL ATOM QUANTUM COMPUTING METHOD AND DEVICE**

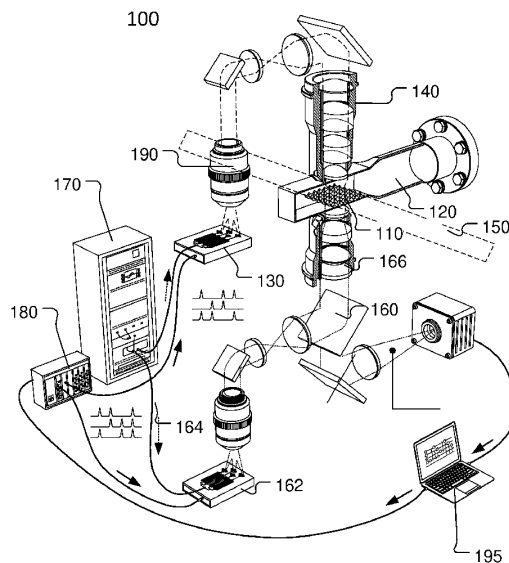


Fig. 1

(57) Abstract: The present disclosure relates to a device and a method for quantum computing using a plurality of neutral atoms in an array of optical traps, wherein a first internal state of the neutral atoms serves as qubit ground state $|0\rangle$, and a second internal state serves as qubit excited state $|1\rangle$. According to the present disclosure, a local single-qubit gate operation on a qubit may be performed comprising locally and selectively illuminating the qubit prepared in a superposition state $|s\rangle$ of qubit ground state $|0\rangle$ and qubit excited state $|1\rangle$ with a qubit addressing laser at a first qubit addressing laser frequency to cause a differential Stark shift for the qubit ground state $|0\rangle$ and the qubit excited state $|1\rangle$. Further, a local two-qubit gate operation may be performed on a pair of qubits comprising locally and selectively illuminating the pair of qubits prepared in the qubit ground state $|0\rangle$ with the qubit addressing laser at a second qubit addressing laser frequency for coupling the pair of qubits to a Rydberg state $|r\rangle$ of the neutral atoms preferably via a third internal

[Continued on next page]

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state $c\rangle$ of the neutral atoms that can serve as an intermediate state of a two-photon transition from the qubit ground state $|o\rangle$ to the Rydberg state $|r\rangle$.