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Overcooled gas flow assisted quantum computing

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This paper is addressed to possibility of implementation of quantum computations by resonant excitation of target isotopologues in overcooled gas flow. The phenomena of quantum states population control by the sequence of laser pulses is proposed to employ. For optimal control of excitation laser pulses should be specifically shaped to selective excite target isotoplogue. Moreover, their periodicity also plays essential role. Supersonically overcooled and rarefied gas flow can be thought as a quantum Turing machine, because molecular spectra are well resolved and have rather long lifetime. Therefore, better control over them by laser field can be implemented. Decoherence level in this ensemble of molecules and clusters, representing gas flow, can be controlled by its rarefaction degree and extension. Evolution of quantum states population is guided by the sequence of femtosecond lasers installed along the gas flow direction. Each laser emits laser pulse of predesigned shape, which is related to some command written for the quantum computer (unitary transformation). Thus, the quantum state in the end of gas flow is the result of calculation. If gas flow transition time is not long enough to complete all sequence of required commands, received final state (intermediate solution) is recorded and translated into laser pulse shape, assigned for initialization. Otherwise, initialization laser pulse is step-like with intensity just high enough to excite all isotopologues to the same quantum state. Final quantum state of the gas flow is read by the classical computer by finalizing measurement, which is implemented as following: Once irradiated gas flow feeds spectrometer, where electrons, corresponding to resulting quantum state, are ejected by applied ionizing laser pulse. Obtained electron energy spectra, bearing information of original optical spectrum, are recorded by the network of surrounding electrodes, and then amplified. By analog-digital convertor electrical currents induced on electrodes are transformed into digital format for further processing on the classical computer.

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