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The STIRAP-based unitary decelerating and accelerating processes of a single free atom XIJIA MIAO — The STIRAP-based unitary decelerating and accelerating processes have been constructed for the physical system of a single free atom. The present theoretical work is focused on investigating analytically how the momentum distribution of a momentum superposition state of a quantum system such as a momentum Gaussian wave-packet state of a single freely moving atom affects the STIRAP state transfer in these decelerating and accelerating processes. The complete STIRAP state transfer and the unitarity of these processes are stressed highly in the investigation. It has been shown that the momentum distribution has an important influence upon the STIRAP state-transfer efficiency. In the ideal adiabatic condition these unitary decelerating and accelerating processes are studied in detail for a freely moving atom. A general adiabatic condition for the basic STIRAP unitary decelerating and accelerating processes is also derived analytically. The unitary decelerating and accelerating processes may be used to manipulate and control in time and space a Gaussian wave-packet motional state of a free atom. The detail work see: Xijia Miao, http://arxiv.org/abs/quant-ph/0707.0063.

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