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ВЫСТРАИВАНИЕ И ОРИЕНТАЦИЯ ЛИНЕЙНЫХ МОЛЕКУЛ ДВУХЦВЕТНЫМИ ТРАПЕЦИЕВИДНЫМИ ЛАЗЕРНЫМИ ИМПУЛЬСАМИ

Теоретически исследовано выстраивание и ориентация линейных молекул с помощью двухцветных трапециевидных лазерных импульсов. Показано, что использование лазерного импульса с трапециевидной формой огибающей увеличивает максимальную степень выстраивания при той же интенсивности и длительности по сравнению с лазерным импульсом гауссовой формы. Исследовано влияние длительности импульса на максимальные значения выстраивания и ориентации молекул. Показано влияние температурных эффектов.

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ALIGNMENT AND ORIENTATION OF LINEAR MOLECULES BY TWO-COLOR TRAPEZOIDAL LASER PULSES

The alignment and orientation of the linear molecule by the two-color trapezoidal laser pulses were theoretically investigated. The use of the trapezoidal shape of a laser pulse enhances the maximum alignment degree for the same intensity and duration comparing to the Gaussian laser pulse. Influence of pulse duration on the maximum degrees of molecule alignment and orientation was investigated. The influence of temperature effects is shown.

Recently, a rapid growth of theoretical and experimental studies of the alignment and orientation in laser and combined fields have been seen. The alignment and the orientation of neutral molecules under free of external static electric field conditions depends on the many laser field parameters such as the intensities, the frequencies, the shapes and the duration times of laser pulses, time of delay between the pulses.

The envelope shapes used by other authors are mainly the Gaussian, $\sin^2$, square shapes. We investigate field-free molecular alignment and orientation by a two-color laser field with the trapezoidal shape of the pulse [1].

Our results showed that the trapezoidal laser pulse allows to enhance the maximum alignment degree for the same intensity and duration comparing to the conventional Gaussian laser pulse.

The calculated dependence of the maximum the degrees of alignment ($\langle\cos^2(\theta)\rangle_{max}$) (a) and orientation ($|\langle\cos(\theta)\rangle|_{max}$) (b) (outside the laser pulse) on the pulse duration τ, depicted in Fig.1 for different temperatures, shows the clear periodic structures in the adiabatic regime.

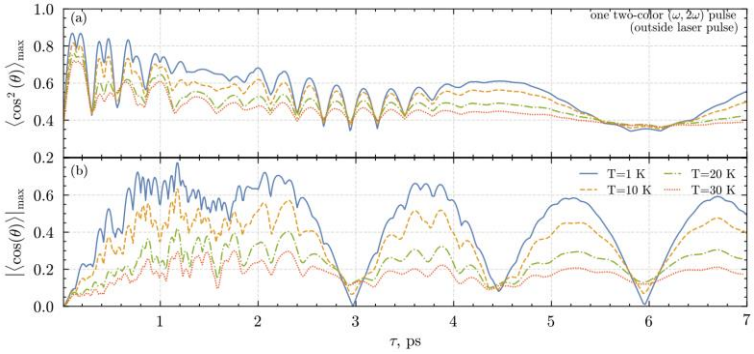

Fig. 1. The dependence of the maximum the degrees of alignment ($\langle\cos^2(\theta)\rangle_{max}$) (a) and orientation ($|\langle\cos(\theta)\rangle|_{max}$) (b) on the trapezoidal laser pulse duration *τ*. The different temperatures *T* = 1, 10, 20, 30 K are indicated by a solid, dashed, dash-dotted and dotted lines respectively.

It is shown that the use of additional preimpulse increases the maximum degree of orientation, and the application of two-color rather than monochromatic preimpulse leads to a higher maximum degree of orientation. The influence of change of relative phase between fundamental and second harmonics on orientation of molecules in the case of one and two impulses was also studied.

Список литературы

1. Koval E. A., Field-free alignment and orientation of linear molecules by two-color trapezoidal laser pulses // arXiv:2312.11777 (submitted to Phys. Rev. A), P.1-9.