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Simple model of dissociation based on time-dependent Faddeev equations

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Faddeev equations play an important role as a backbone of computational and theoretical models of quantum few-body systems in nuclear, atomic and molecular physics. Traditionally, they are used in the context of bound state and scattering calculations in stationary approach. The Faddeev decomposition of the operator can also be efficiently used for theoretical and numerical modeling of essentially non-stationary processes, such as dissociation and ionization of molecular ions in the external non-stationary fields. Here we take a step towards more extensive usage of the Faddeev decomposition for non-stationary systems by giving an example of a simple model of the positive Hydrogen ion dissociation in a short intense laser field.
As is mentioned by Belyaev [1], the Faddeev decomposition allows us to formulate the simplest possible model of interatomic interaction by using a single two-body state projection of different components of the interaction, which, unlike the traditional quantum chemistry approach, gives the results that are qualitatively comparable to the exact treatment of the problem. By including a non-stationary interaction with an external field we come to a system of non-stationary Faddeev equations that we solve numerically. We compare the dissociation probability and the kinetic energy release (KER) for the dissociated state obtained in the new and the more traditional time-dependent Schroedinger equation approaches [2].

1. Vladimir B. Belyaev, Lectures on the Theory of Few-Body Systems, Springer Verlag (1990).
2. V. Roudnev and B.D. Esry, Phys. Rev. A. 71, 013411 (2005).

The speaker is a student or young scientist

No

Section

1. Nuclear structure: theory and experiment

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