Excitation and Ionization of a Hydrogen Atom in Elliptically Polarized Strong Laser Fields with Discrete Variable Representation

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The nondirect product discrete variable representation (npDVR) is developed for the time-dependent Schrödinger equation with nonseparable angular variables and is applied to the hydrogen atom in an elliptically polarized strong laser field. The 2D npDVR basis is constructed on spherical functions orthogonalized on the grids of the Popov 2D quadratures for the unit sphere [1]. With this approach, we have investigated the dynamics of a hydrogen atom initially in its ground state in a strong laser field with the intensity up to $I = 10^{14}$ W/cm^2 and wavelength of $\lambda = 800$ nm. We show that due to the special structure of Popov grids on a unit sphere, the DVR method based on Popov quadratures acts most efficiently when dealing with a laser field of circular polarization and gives results rapidly converging to the corresponding values from a recent article [2]. We also propose a novel, simple procedure for calculating total ionization yield and prove its accuracy by comparing with conventional methods.

Acknowledgements: The work was supported by the Russian Science Foundation under Grant No. 20-11-20257.

References

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