Electron Correlations in the Framework of the Quasi Sturmians Approach

Alexander S. Zaytsev[1], Maxim S. Aleshin[1], Lorenzo Ugo Ancarani[2], Sergey A. Zaytsev[1]
1. Pacific National University, Khabarovsk, 680035, Russia
2. Equipe TMS, SRSMC, UMR CNRS 7565, Université de Lorraine, 57078 Metz, France

In the construction of solutions for the Coulomb three-body scattering problem one encounters a series of mathematical and numerical difficulties, one of which are the cumbersome boundary conditions the wave function should obey. We propose to describe a Coulomb three-body system continuum with a set of two-particle functions, named Convoluted Quasi Sturmian (CQS) in [1]. They are built using recently introduced Quasi Sturmian (QS) functions [2, 3] which have the merit of possessing a closed form. Unlike a simple product of two one-particle functions, by construction, the CQS functions look asymptotically (as the hyperradius goes to infinity) like a six-dimensional outgoing spherical wave. The proposed CQS basis is tested through the study of the double ionization of helium by high-energy electron impact in the framework of the Temkin-Poet model [4]. An adequate logarithmic-like phase factor is further included in order to take into account the Coulomb interelectronic interaction and formally build the correct asymptotic behavior when all interparticle distances are large. With such a phase-factor (that can be easily extended to take into account higher partial waves) rapid convergence of the expansion can be obtained.

References

[1] A. S. Zaytsev, L. U. Ancarani and S. A. Zaytsev, Eur. Phys. J.Plus **131**, 48 (2016).
[2] J. A. Del Punta, M. J. Ambrosio, G. Gasaneo, S. A. Zaytsev and L. U. Ancarani, J. Math. Phys. **55**, 052101 (2014).
[3] M. S. Aleshin , S. A. Zaitsev, G. Gasaneo, L. U. Ancarani, Russian Physics Journal, **58**, 941 (2015).
[4] G. Gasaneo, D. M. Mitnik, J. M. Randazzo, L. U. Ancarani and F. D. Colavecchia, Phys. Rev. A **87**, 042707 (2013).