Computational approaches to many-body dynamics of unstable nuclear systems[†]

Alexander Volya
Florida State University, Tallahassee, FL, 32306, USA

The availability of advanced computational technologies call for innovative thinking and for new philosophies in addressing the quantum many-body problems. In this presentation using different model and realistic examples from the world of nuclear physics we discuss computational strategies and techniques for dealing with dynamically unstable many-body systems. We examine the use of direct time-dependent techniques for multi-channel problems of scattering and tunneling; here the virtual, energy-forbidden channels and their treatment are of particular importance[1]. We briefly revisit the general theory of the quantum decay of unstable states. The list of questions includes the internal dynamics in the decaying system, the formation and evolution of the radiating state, and, finally, low-energy s-wave background that survives at remote times. Mathematical formulations and numerical approaches to time-dependent problems will be discussed using the quasi-stationary methods that involve effective Non-Hermitian Hamiltonian formulations [2,3]. Finally, direct continuum discretization and the variable phase method provide yet another approach for the many-body time-dependent dynamics to be explored.

[1] N. Ahsan and A. Volya, Phys. Rev. C **82**, 064607 (2010).
[2] A. Volya, Phys. Rev. C **79**, 044308 (2009).
[3] V. Zelevinsky, A. Volya, Yad. Fiz. **77**, issue 7, 1-14 (2014).

[†] This work is supported by the U.S. Department of Energy under contract DE-SC0009883