DNP07-2007-000188

Abstract for an Invited Paper
for the DNP07 Meeting of
the American Physical Society

Shell Model Approach to Many-Body Open Quantum Systems[1]

JIMMY ROTUREAU, Oak Ridge National Laboratory/University of Tennessee

The theoretical description of weakly-bound/unbound nuclei requires the treatment of the many-body correlations, the continuum of positive-energy states and decay channels. Solution of this problem has been advanced recently in the open quantum system formulation of the nuclear shell model (SM), the so-called Gamow Shell Model (GSM). GSM is the SM with a single-particle (s.p.) basis given by the Berggren ensemble consisting of Gamow states and the non-resonant continuum of scattering states. The principal limitation of GSM applications is the explosive growth in the number of configurations with both the number of particles and the size of the s.p. space. To ensure completeness of the basis, one should include a large set of non-resonant continuum states. Because of their presence, the dimension of the matrix representing the Hamiltonian $H_{\rm GSM}$ grows extremely fast and this matrix is also significantly denser than that of a conventional SM. To overcome these difficulties, we propose a method based on the density matrix renormalization group (DMRG) approach for finding the eigenstates of $H_{\rm GSM}$. During my presentation I will show results we obtained for the description of weakly-bound/unbound states for Helium and Lithium isotopes.

[1]In collaboration with Nicolas Michel, University of Kyoto; Marek Ploszajczak, GANIL, France; Witek Nazarewiczm, ORNL/UT; and Jorge Dukelsky, Instituto de Estructura de la Materia.