

Calculation of Binding Energy of Four-Body Bound State by Using Low - Momentum Effective Interaction $V_{low,k}$

Abstract

$V_R[MeV]$	μ_R	$V_A[MeV]$	μ_A
1485.05	3.11	578.09	1.55

Table 1: The coefficients of the Malfliet - Tjon type V

It is form of eigenvalue equation. The way for solving this equation is Lanczos method, which is based on iteration [?, 14] The iteration of the integral Eq. (26) requires a very large number of two -dimensional interpolations on the Yakubovsky component and t-matrix, to this aim we have used Cubic-Hermitian Splines to reach high computational accuracy and speed [appendix 3 in ref. 12].The iteration process starts with two Gaussian functions for ψ_1, ψ_2 . The iteration is done 8 times for getting valid results. Finally the energy that match the eigenvalue $\lambda(E) = 1$ is the answer. So we should probe the eigenvalues. The grid points for azimuthal angle variables are 20. Calculated binding energy for cutoff $\Lambda = 2.1 fm^{-1}$ in different grid points for 4He is shown in table 2.

N_{sph}	N_{jac}	$E_b[MeV]$
12	20	-31.760
16	20	-31.763
24	20	-31.763
28	20	-31.763
20	20	-31.763
20	24	-31.746
20	28	-31.739
20	32	-31.734
20	36	-31.733

Table 2: four-body binding energy to the cutoff of low-momentum interaction for MT-V potential in cutoff $\Lambda = 2.1 \text{ fm}^{-1}$ in different grid points

In figure 1 the dependence of four-body binding energy to the cutoff of low-momentum potential Λ is shown.

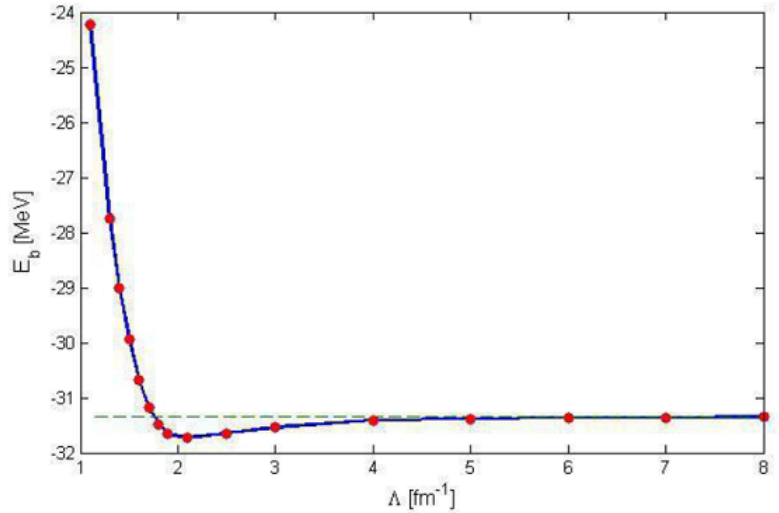


Figure 1: the dependence of four-body binding energy to the cutoff of low-momentum potential Λ (bold line), calculated binding energy of four-body system by bare potential (...)

Obviously, the four-body binding energy is strongly cutoff dependent for small values of cutoffs, whereas for values larger than 6.0 fm^{-1} it is almost cutoff independent and leads to bare potential binding energy. This cutoff dependency is quite reasonable, because in $V_{low,k}$ three and four - body forces haven't been corresponded. Summary:

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