

1 - 9 Sub Coulomb Barrier $d+^{208}\text{Pb}$ Scattering in the Time-dependent Basis Function Approach*

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We employ the non-perturbative time-dependent basis function (tBF) approach to study the scattering of the deuteron on ^{208}Pb below the Coulomb barrier. We obtain the bound and discretized scattering states of the projectile, which form the basis representation of the tBF approach, by diagonalizing a realistic Hamiltonian in a large harmonic oscillator basis. We find that the higher-order inelastic scattering effects are noticeable for sub barrier scatterings with the tBF method. We have successfully reproduced experimental sub Coulomb barrier elastic cross section ratios with the tBF approach by considering only the electric dipole ($E1$) component of the Coulomb interaction between the projectile and the target during scatterings. We find that the correction of the polarization potential to the Rutherford trajectory is dominant in reproducing the data at very low bombarding energies, whereas the role of internal transitions of the deuteron projectile induced by the $E1$ interaction during the scattering becomes increasingly significant at higher bombarding energies. See Ref. [1] for details.

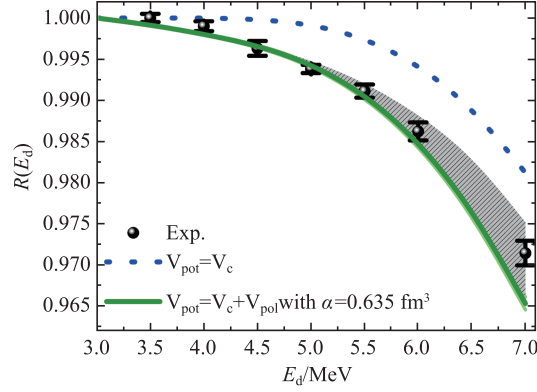


Fig. 1 (color online) Elastic cross section ratios $R(E_d)$ with $(\theta_1, \theta_2) = (60^\circ, 150^\circ)$, as a function of the bombarding energy E_d . The dark green solid curve and the blue dotted curve represent the tBF results with and without the correction of the polarization potential to the Rutherford trajectory, respectively. The light green band represents the uncertainty induced by a 5% change of the $E1$ polarizability of the deuteron. The light grey band denotes the uncertainty induced by energy loss during the scattering. The experimental data of $R(E_d)$ (black solid dots with error bars) are also shown for comparison.

Reference

- [1] P. Yin, W. Du, W. Zuo, et al., J. Phys. G, 49, 12(2022)125102.

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