Investigation of $^{16}\text{O} + ^{16}\text{O}$ elastic scattering using the $\alpha$-cluster folding model


Abstract:

Angular distributions of $^{16}\text{O} + ^{16}\text{O}$ elastic scattering at energies that range from 124 to 1120 MeV have been analyzed in the framework of the double folding (DF) optical model. Based upon the $\alpha$-cluster structure of the $^{16}\text{O}$ nucleus, two different versions of the real DF optical potential have been generated by using three effective $\alpha-\alpha$, $\alpha$-nucleon (N) and nucleon-nucleon (NN) interactions. A microscopic optical potential built upon the M3Y effective NN interaction and the matter density distribution of the $^{16}\text{O}$ nucleus has also been extracted. The obtained real potentials, in conjunction with phenomenological squaredWoods-Saxon imaginary parts, have successfully reproduced seven sets of elastic-scattering data. No renormalization of the real folded $\alpha$-cluster potentials is required to fit the data. The energy dependence of the extracted real and imaginary volume integrals and total reaction cross section has also been investigated.

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