Importance of three-body forces for nucleus-nucleus scattering

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An analysis of nucleus-nucleus elastic scattering is made by the double folding model (DFM) with new complex G-matrix interactions called CEG07 proposed by Ref. [1]. The CEG07 interactions were calculated with the use of a modern NN interaction called extended soft core (ESC) model interaction [2, 3] with and without the (repulsive and attractive) three body forces (TBF) included. We evaluated the G-matrix interaction up to high densities (about twice the normal density) so as to be applied to the calculation of the optical potential at high-density overlap region in nucleus-nucleus collisions.

We have tested the present microscopic DFM optical potential with the CEG07 interactions in the ^{12}C, ^{16}O elastic scattering by ^{12}C, ^{16}O, ^{28}Si, and ^{40}Ca. The experimental cross sections for incident energies ranging from E/A = 50 to 200 MeV are well reproduced by the present microscopic optical model only when the TBF e ect is included. The typical results, ^{16}O + ^{16}O elastic scattering at E=A = 70 MeV, are shown in Fig. 1. The e ect of TBF is clearly seen both in the potential and cross sections and the calculation with TBF well reproduces the exparimental data up to backward angles. This indicates that the e ect of TBF is very important not only for nuclear saturation properties and its application to astrophysical problems but also for proper understanding of the nucleus-nucleus scattering.

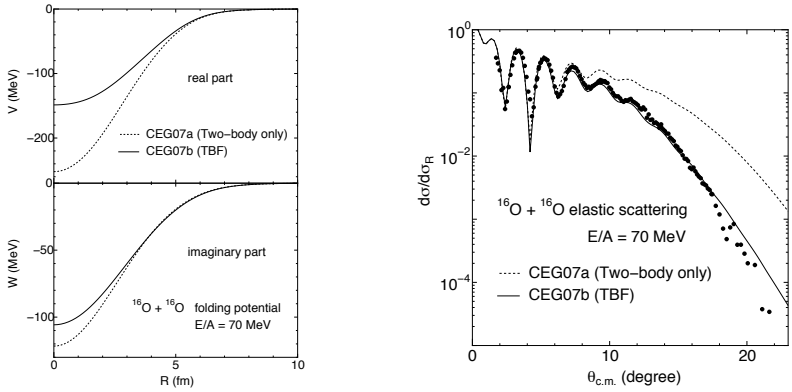

FIG. 1: The left figure shows the double folding potentials with CEG07 for ^{16}O + ^{16}O at E=A = 70 MeV. The right figure shows the ratios of cross sections for elastic scattering to the Rutheford cross sections. The dotted curves are the results of DFM calculation without the TBF e ect, while the solid curves are the results with the TBF e ect. The experimental data are taken from Ref. [4].

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