Modified Single-Folded Potentials for the Alpha-²⁴Mg and Alpha-²⁸Si Elastic Scattering

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Abstract : Alpha-nucleus interaction is obscured because it produces enhanced cross-sections at large scattering angles known as anomaly in large angle scattering (ALAS). ALAS is prominent in the elastic scattering of α -particles as well as in nonelastic processes involving α -particles for incident energies up to 50 MeV and for targets of mass A \leq 50. The Woods-Saxon type of optical model potential fails to describe the processes in a consistent manner. Folded potential is a good candidate and often used to construct the potential which is derived from the microscopic as well as semi-microscopic folding calculations. The present work reports the analyses of the elastic scattering of α -particles from ²⁴Mg and ²⁸Si at E α =22-100 MeV and 14.4-120 MeV incident energies respectively in terms of the modified single-folded (MSF) potential. To derive the MSF potential, we take the view that the nucleons in the target nuclei ²⁴Mg and ²⁸Si are primarily in α -like clusters and the rest of the time in unclustered nucleonic configuration. The MSF potential, found in this study, does not need any renormalization over the whole range of incident α energies, and the renormalization factor has been found to be exactly 1 for both the targets. The best-fit parameters yield $4A\alpha = 21$ and AN = 3 for α -²⁴Mg and ²⁸Si are also deduced, and the results obtained from this work agree well with the outcomes of other studies.

Keywords : elastic scattering, optical model, folded potential, renormalization

Conference Title : ICNPA 2018 : International Conference on Nuclear Physics and Astrophysics

Conference Location : London, United Kingdom

Conference Dates : March 15-16, 2018

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