Abstract

In this work, the proton - nucleus elastic scattering process is modeled by adding, to the conventional optical potential, a surface term that is proportional to the gradient of the nuclear matter density of the target nucleus. For proton energies below 30 MeV the added gradient term resulted in excellent fits to the elastic angular distributions and very good theoretical predictions for the corresponding polarization data. However, for larger incident energies, an additional volume term that is proportional to nuclear matter density was necessary to restore the good theoretical predictions for the polarization data. We consider elastically scattered protons off light and heavy spin-zero nuclei ranging from ^{12}C to ^{58}Ni. Total reaction cross sections calculated using the modified optical model agree well with the corresponding data published in the literature. The volume integrals per nucleon and root mean square radii of the potential components have also been determined and are in agreement with the corresponding values calculated using other models.